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(19)

(54) HEAT-RESISTANT CHOCOLATE PRODUCT AND METHOD OF MANUFACTURING SAME

(71) We, CADBURY LIMITED, a British Company of Bournville, Birmingham, England, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a shaped chocolate product and to a method of manufacturing same.

Shaped chocolate and chocolate flavoured products, e.g. bars of chocolate, when conventionally produced, consists of sugar crystals and cocoa particles dispersed through a fat phase which, in the case of dark chocolate, is principally cocoa butter and, in the case of milk chocolate, consists of dairy butter and cocoa butter. Milk chocolate normally contains 42% by weight of sugar, 30% by weight of fat, and 28% by weight of milk solids. The advantage of such chocolate is that it is a material which melts readily in the mouth, thus quickly releasing its characteristically pleasant flavour. However, it is a disadvantage of such chocolate that it is sensitive to heat, and temperatures above the melting point of the fat causes the chocolate to melt and flow. This means that such chocolate is difficult to handle, particularly where ambient temperatures are relatively high. The heat of the hand can melt such chocolate thus making it inconvenient to handle.

It has previously been proposed to prepare a heat resistant chocolate which consists of a sugar structure in which fatty substances are incorporated. Such a preparation process, however, involves the preparation of a first mass containing sugar in a predominantly amorphous form and mixing, at a temperature not exceeding 35—40°C, the first mass with a second mass of conched chocolate containing sugar in a crystallised form. After moulding and packing in a hermetic wrapper, the product is then heat treated by keeping it at a constant temperature between 20°C and 35°C for a period of ten to sixty days during which time a sugar skeleton or edifice forms within the chocolate product to impart a heat resistance thereto. This is still a continuous fat phase chocolate with conventional appearance.

A disadvantage of such a process is that it involves the production of two different masses which involves the use of two different types of equipment. Another disadvantage of such a process is that it involves a lengthy heat treatment at a carefully controlled temperature before the heat resistance is fully developed.

A disadvantage of the product of such a process is that although it possesses a certain amount of heat resistance, fat melting occurs at elevated ambient temperatures even though the overall structure of the product does not disintegrate as occurs with conventional chocolate products.

An object of the present invention is to provide an improved shaped, heat resistant chocolate product and an improved process for preparing such a product in which the above disadvantages are obviated or mitigated.

According to one aspect of the present invention, there is provided a method of manufacturing a shaped heat-resistant chocolate product comprising the steps of (i) thoroughly mixing at least water, 15% to 35% by weight of at least one edible fat based on the total weight of the edible composition, and not less than 40% by weight of sugar based on the total weight of the edible composition, so as to produce an emulsion of said at least one edible fat with an aqueous sugar solution, (ii) whilst maintaining said at least one edible fat emulsified with the solution, evaporating sufficient water from the solution to inhibit separation of said at least one edible fat from the solution, (iii) shaping the resultant evaporated mixture, and (iv) drying the shaped mixture so ase to produce a shaped heat-resistant chocolate product having a moisture content of not more than 5% by weight and in which individual particles of said at least one edible fat are encapsulated in a sugar glass.

Preferably, a permitted emulsifier is included in the solution and is used in amounts in which emulsifiers are normally used e.g. up to 1% by weight of the aqueous solution.

The drying step is preferably effected to give a moisture content of not more than 2% by weight.

The amount of water used in the mixing step is sufficient to enable ready mixing of the ingredients and is preferably greater than 15% by weight of the mixture. Typically, the water content forms 20% by weight of the mixture. Very high water contents are not preferred in view of the fact that it is necessary to remove the water subsequently and the use of large proportions of water increases energy consumption at the evaporation stage.

The moisture content after the evaporation step is typically 10% by weight. However, the moisture content at this stage can be varied depending upon whether the fat chosen is one which is or is not maintained readily in emulsion.

Preferably, said at least one edible fat is cocoa butter. However, it is within the scope of the present invention to employ any edible animal or vegetable fat as a partial or full replacement of cocoa butter. For example, hardened palm kernel oil or a cocoa butter replacement fat, e.g. as disclosed in "Chocolate, Cocoa and Confectionery: Science and Technology" by Bernard W. Minifie, 1970, may be employed.

In the case where non-fat cocoa solids are omitted, a white chocolate is produced. For a chocolate product which is not a white chocolate, the cocoa solids are included with the water, sugar, and edible fat. For a chocolate product which is milk chocolate, milk solids are included with the water, sugar, edible fat, cocoa solids and emulsifier.

The present invention is applicable to any chocolate product, and the ranges of the ingredients present in the chocolate product may be limited only by the prevailing regulations in a particular country concerning the sale in that country of designated chocolate products whether such products be sold as "chocolate", "plain chocolate", "milk chocolate", or "white chocolate". For example, under E.E.C. regulations, for the chocolate product to be sold as "chocolate" it must be formed from cocoa nib, cocoa mass, cocoa powder or fat-reduced cocoa powder and sucrose with or without added cocoa butter and have a minimum total dry solids content of 35% and at least 14% of dry non-fat cocoa solids and 18% of cocoa butter not counting any other permitted additives such as permitted flavourings and emulsifier (lecithin). Also, under E.E.C. regulations, for a chocolate product to be designated a milk chocolate, it must contain at least 25% fat and, even when fat reduced cocoa powder is employed, at least 8% of this fat must be cocoa butter. Preferably, however, the cocoa butter content is at least 14.7%.

The above-described process differs from processes which have been used previously to produce milk crumb for milk chocolate manufacture in that such milk crumb production process acoid "locking" of the fat (milk solids and cocoa butter) in the sugar phase whereas the process of the present invention seeks to provide just such a locking of the fat (cocoa butter and milk fat, if used) in the sugar phase to impart a heat resistance to the edible composition.

The chocolate product may be produced in an expanded form by introducing a gas into said residue, or by flash heating, preferably under reduced pressure, said residue in order to effect the drying step, or by a combination of the two aforementioned steps. In an expanded form, the product may have a density as little as 0.2—0.3 grams/cc (conventionally produced, unexpanded chocolate, for example, typically has a density of approximately 1.2 grams/cc).

Advantageously, the drying step is effected by injecting the residue through at least one injection nozzle onto a supporting surface in a vacuum chamber.

Conveniently, the supporting surface is provided by a conveyor which conveys the injected material from a heated zone in the vacuum chamber to a cooler, solidification zone in the vacuum chamber.

The residue may be injected continuously onto the moving conveyor so as to produce at least one continuous length of the emulsified residue to be dried, the continuous length being cut to the desired length in the vacuum chamber before being discharged therefrom.

The chocolate product can be enrobed with a conventional chocolate or other coating. Thus, an initial "conventional chocolate texture" can be attained when the product is first put in the mouth by utilising a chocolate product of the present invention provided with a conventional chocolate enrobing.

According to another aspect of the present invention, there is provided a shaped, temperature resistant chocolate product containing 15% to 35% by weight of at least one edible fat, not less than 40% by weight sugar, and, optionally, a permitted emulsifier, wherein said at least one edible fat is present as individual particles which are separated from one another in a sugar glass so that a substantially discontinuous fat phase is provided in the composition.

In such a product, there is little chance of fat seepage until temperatures which are sufficiently high to melt the sugar glass

itself are encountered (e.g. temperatures in the region of 160°F to 180°F).

With such a product, a fat determination using a fat solvent extraction technique on an uncominuted sample reveals a substantially zero or very low fat content in spite of the presence of at least 15% fat. This demonstrates that the fat is "locked" into the sugar glass and is not free to seep out of the composition at elevated ambient temperatures.

Because of its relative heat stability in spite of the high fat content, a chocolate product according to the invention can be sold in the form of relatively thin pieces which, if formed of conventional chocolate with a similar fat content, would melt extremely readily when handled. It is thus possible, with a chocolate product according to the invention, to sell a package containing a number of thin pieces or wafers which, although not individually wrapped, will not adhere to one another within the package and which can be eaten as a pleasant alternative to potato crisps or the like. This is a surprising property of the product bearing in mind the high fat content of the composition.

Embodiments of the present invention will now be described in the following examples:

EXAMPLE 1

The chocolate ingredients as set out in the table below were dispersed in water at a temperature of substantially 100°F.

TABLE

Ingredients	Percentage by weight
Full cream milk solids	28.2
Sucrose	32.7
Cocoa solids (fat free)	4.0
Cocoa butter	13.5
Lecithin (Emulsifier)	0.4
Water (including moisture content of above ingredients)	21.2

An aqueous sugar solution resulted which contained the full cream milk solids, cocoa solids, cocoa butter and emulsifier. This mixture was then passed into a high speed turbine mixer (alternatively a milk homogeniser could be used) whereby the full cream milk solids, cocoa solids, and cocoa butter were emulsified with the aqueous sugar solution for 5 minutes. The resultant emulsion was then pumped to a wiper film vacuum evaporator operating at 306 r.p.m., 10 ins. of mercury, and a temperature of 180—185°F. In the evaporator, the material was maintained in emulsion and the moisture content reduced to approximately 10% by weight so that a paste was produced which could not readily de-emulsify. The emulsified paste from the evaporator was then pumped, via a pump which introduced a proportion of air into the paste, into a vacuum band dryer operating at 28—29 ins. of mercury vacuum. The aerated, emulsified paste was fed onto the band dryer through a plurality of injection nozzles which served to shape the paste, the inlet temperature of the paste being in the region of 150°F—180°F. Heated platens were provided in a first zone of the dryer into which the injection nozzles discharged. The injected material was carried by the band along the dryer and past cooling platens in a further stage. As the paste on the band passed along the dryer, expansion thereof took place to produce a cellular material having a density of approximately 0.25 grms per cc. Continuous lengths of the material were produced and cut to size by means of a guillotine in the cooling zone of the band dryer. The material cut to length was discharged from the dryer through an airlock. The milk chocolate product thereby formed contained 35.8% full cream milk solids, 41.5% sucrose, 5% cocoa solids, 17.2% cocoa butter, 0.5% lecithin and only a trace of moisture (Total fat content= 26.1% by weight, total sugar content= 41.5% by weight).

The product was then packed into suitable packs for direct consumption. It was found that the product could withstand temperatures as high as 150°F without any breakdown of the physical structure.

As an alternative, the shaped product could have been transferred to a conventional chocolate enrobing machine and coated with chocolate or other edible coating before packing.

EXAMPLE 2

Example 1 was repeated except that hardened palm kernel oil was used in the place of the cocoa butter to produce an expanded chocolate-like confection which could have been eaten as produced or enrobed with a chocolate, chocolate-like or other coating.

EXAMPLE 3

Example 1 was repeated using ingredients to give an expanded chocolate product having the following compositions (by weight):

sucrose—34.9%;	glucose solids—4.9%
whole milk solids—37.3%;	cocoa butter+ Cadbury* YN (emulsifier fat)—16.3%
Non-fat cocoa solids—4.8%;	moisture—1.8%

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The total fat content of the product was 26.1% and the total sugar content was

39.8%. The glucose solids were added to reduce the risk of sugar crystallisation during drying.

EXAMPLE 4

Example 1 was repeated using ingredients to give an expanded plain chocolate product having the following compositions (by weight):—

sugar—65.0%; Non-fat cocoa solids—14.0%; cocoa butter—20.5%; lecithin (emulsifier)—0.5%; moisture—nil

(total fat=21%; total sugar=65.0%).

EXAMPLE 5

Example 1 was repeated using ingredients to give an expanded plain chocolate product having the composition (by weight):—

sugar—40.0%; non-fat cocoa solids—35.0%; cocoa butter—24.5%; lecithin (emulsifier)—0.5%; moisture—nil.

(Total fat=25.0%; total sugar=40%.)

EXAMPLE 6

Example 1 was repeated using ingredients to give an expanded milk chocolate product having the following composition (by weight):—

sugar—55.0%; non-fat cocoa solids—2.5%; whole milk solids—14.0%; cocoa butter—28.0%; lecithin (emulsifier)—0.5%; moisture—nil.

(Total fat=32%; total sugar=55%.)

EXAMPLE 7

Example 1 was repeated using ingredients to give an expanded milk chocolate product having the following ingredients (by weight):—

sugar—41.0%; non-fat cocoa solids—10.0%; whole milk solids—28.0%; cocoa butter—20.5%; lecithin (emulsifier)—0.5%; moisture—nil.

(Total fat=28%; total sugar=41.0%.)

EXAMPLE 8

Example 1 was repeated using ingredients to give an expanded candy product having the following composition (by weight):—

sugar—56.0%; non-fat cocoa solids—5.0%; whole milk solids—32.0%; cocoa butter (or non-cocoa butter vegetable fat or animal fat or a mixture thereof)—6.5%; lecithin (emulsifier)—0.5%; moisture—nil.

(Total fat=15%; total sugar=56.0%.)

EXAMPLE 9

Example 1 was repeated using ingredients to give an expanded candy product having the following composition (by weight):—

Sugar—54.5%; non-fat cocoa butter—8.0%; whey solids—5.7%; cocoa butter (or non-cocoa butter vegetable fat or animal fat or a mixture thereof)—30.7%; lecithin (emulsifier)—1.1%; moisture—nil.

(Total fat=31.8%; total sugar=54.5%.)

EXAMPLE 10

Example 1 was repeated using ingredients to give an expanded candy product having the following composition (by weight):—

Sugar—41.5%; non-fat cocoa solids—3.85%; whole milk solids—12.0%; non-fat milk solids—11.1%; cocoa butter (or non-cocoa butter vegetable fat or animal fat or a mixture thereof)—30.80%; lecithin (emulsifier)—0.75%; moisture—nil.

(Total fat=34.7%; total sugar=41.5%.)

EXAMPLE 11

Example 1 was repeated using ingredients to give an expanded white candy product having the following ingredients (by weight):

Sugar—43.5%; whole milk solids—21.2%; whey solids—6.0%; cocoa butter (or non-cocoa butter, vegetable fat or animal fat or a mixture thereof)—28.7%; lecithin (emulsifier)—0.6%; moisture—nil.

(Total fat content=34.6%; total sugar content=43.5%.)

In the above Examples heated platens were used in the vacuum dryer. Instead, the material may be heated by micro-wave energy to improve the efficiency of heat transfer.

A partially expanded product can be obtained without the use of a vacuum dryer by using micro-wave energy alone, the micro-wave energy serving to effect a flash evaporation at the drying stage to produce a partially aerated material having a density of about 0.7—0.8 grams per cc.

As an alternative to using a pump which introduced a proportion of air into the paste to transfer the emulsified paste from the evaporator to the dryer, a double-screw aerator can be employed to give a rather more positive and accurately controllable incorporation of air into the emulsified paste.

The sugar used in the above Examples can include a proportion of glucose solids or dextrose to inhibit crystallisation of the sugar glass.

In all of the above described examples the edible fat or fats are incorporated into a sugar glass so that a discontinuous fat phase occurs and individual fat particles are separated from one another by the sugar glass structure.

The above-described process of manufacturing a shaped chocolate product requires only the mixing of a single mass of ingredients and does not necessitate heat treatment of the product over a long period of time to develop the heat-resistant characteristics.

The process according to the present invention can utilise the same ingredients in the same proportions as are used in conventional chocolate so that the flavour of chocolate produced by the process of the present invention can be made to resemble closely that of conventional chocolate

although the texture will be somewhat different.

WHAT WE CLAIM IS:—

1. A method of manufacturing a shaped, heat-resistant chocolate product comprising the steps of (i) thoroughly mixing at least water, 15% to 35% by weight of at least one edible fat based on the total weight of the edible composition, and not less than 40% by weight of sugar based on the total weight of the edible composition, so as to produce an emulsion of said at least one edible fat with an aqueous sugar solution, (ii) whilst maintaining said at least one edible fat emulsified with the solution, evaporating sufficient water from the solution to inhibit separation of said at least one edible fat from the solution, (iii) shaping the resultant evaporated mixture, and (iv) drying the shaped mixture so as to produce a shaped, heat-resistant chocolate product having a moisture content of not more than 5% by weight and in which individual particles of said at least one edible fat are encapsulated in a sugar glass.

2. A method as claimed in claim 1, wherein a permitted emulsifier is included in the solution.

3. A method as claimed in claim 1 or 2, wherein the drying step is effected to give a moisture content of not more than 2%.

4. A method as claimed in any preceding claim, wherein said at least one edible fat is at least partially constituted by cocoa butter.

5. A method as claimed in any preceding claim, wherein said aqueous solution further contains cocoa solids.

6. A method as claimed in any preceding claim, wherein the product is produced in expanded form.

7. A method as claimed in claim 6, wherein the product is produced in expanded form by introducing a gas into said residue.

8. A method as claimed in claim 6 or 7 wherein the product is produced in expanded form by flash heating said residue in order to effect the drying step.

9. A method as claimed in claim 8, wherein said flash heating is effected under reduced pressure.

10. A method as claimed in any preceding claim, wherein said drying step is effected by injecting the residue through at least one injection nozzle onto a supporting surface in a vacuum chamber.

11. A method as claimed in claim 10, wherein the residue is injected onto a moving conveyor which conveys the injected material from a heated zone in the vacuum chamber to a cooler, solidification zone in the vacuum chamber.

12. A method as claimed in claim 11, wherein the residue is injected continuously onto the moving conveyor so as to produce at least one continuous length of the emulsified residue to be dried, the or each continuous length being cut to the desired length in the vacuum chamber before being discharged therefrom.

13. A method as claimed in any preceding claim, including the step of enrobing the chocolate product from the drying step with a chocolate or other coating.

14. A shaped heat-resistant chocolate product containing 15% to 35% by weight of at least one edible fat, and not less than 40% by weight sugar wherein said at least one edible fat is present as individual particles which are separated from one another in a sugar glass so that a substantially discontinuous fat phase is present in the product.

15. A product as claimed in claim 14, having a moisture content of not more than 2% by weight.

16. A product as claimed in claim 14 or 15 containing 20% to 30% by weight of said at least one edible fat.

17. A product as claimed in any one of claims 14 to 16 further containing cocoa solids.

18. A product as claimed in any one of claims 14 to 17, wherein said sugar content includes up to 5% glucose solids or dextrose.

19. A product as claimed in any one of claims 14 to 18, wherein the fat content includes an emulsifier fat.

20. A product as claimed in any one of claims 14 to 19, wherein said at least one edible fat is partially or wholly constituted by cocoa butter.

21. A product as claimed in any one of claims 14 to 20, including milk solids.

22. A product as claimed in any one of claims 14 to 21, in expanded form.

23. A shaped, heat-resistant chocolate product substantially as hereinbefore described in any one of Examples 1 to 11.

24. A method of manufacturing a shaped, heat-resistant chocolate product substantially as hereinbefore described in any one of Examples 1 to 11.

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